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SAMPLING AND ANALYSIS PLAN
FOR ACTIVITY-BASED OUTDOOR AIR EXPOSURES
OPERABLE UNIT 4
LIBBY, MONTANA, SUPERFUND SITE

Prepared by
US Environmental Protection Agency
Region 8
Denver, CO

With Technical Assistance from:

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Denver, CO

and

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APPROVAL PAGE

This Activity-Based Outdoor Air Sampling Plan for Operable Unit 4 of the Libby, Montana, Superfund Site has been prepared by the U.S. Environmental Protection Agency, Region 8, with technical support from Syracuse Research Corporation and CDM, Inc. Study activities addressed in this Plan are approved.

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DOCUMENT REVISION LOG

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CAR	Corrective Action Request
CIC	Community Involvement Coordinator
DQOs	Data Quality Objectives
EABS	Exterior Activity Based Sampling
ED	Exposure Duration
EDD	Electronic Data Deliverable
EF	Exposure Frequency
EPA	Environmental Protection Agency
ERT	Emergency Response Team
ET	Exposure Time
FSDS	Field Sample Data Sheet
FSP	Field Sampling Plan
GO	Grid Opening
GPS	Global Positioning System
HQ	Hazard Quotient
ISO	International Organization for Standardization
LA	Libby Amphibole
MCE	Mixed-Cellulose Ester
MET	Meteorological
NSUA	Non-Specific Use Area
NVLAP	National Voluntary Laboratory Accreditation Program
PLM	Polarized Light Microscopy
PLN	Poisson Lognormal
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
RAM	Real-Time Aerosol Monitor
RBF	Risk-Based Fraction
RfC	Reference Concentration
SAP	Sampling and Analysis Plan
SQAPP	Supplemental Quality Assurance Project Plan
SUA	Specific Use Area
SWQAPP	Site-Wide Quality Assurance Project Plan
TEM	Transmission Electron Microscopy
TL	Team Leader
TWF	Time Weighting Factor
UCL	Upper Confidence Limit
UR	Unit Risk
VCI	Vermiculite Containing Soil
VI	Vermiculite Insulation

SAMPLING AND ANALYSIS PLAN
FOR ACTIVITY-BASED OUTDOOR AIR EXPOSURE
OPERABLE UNIT 4
LIBBY, MONTANA, SUPERFUND SITE

1.0 INTRODUCTION

This document is the Sampling and Analysis Plan (SAP) for the collection and analysis of samples of outdoor air in the immediate vicinity of activities that actively disturb outdoor soil at residential and commercial properties located within Operable Unit 4 of the Libby, Montana, Superfund Site. Operable Unit 4 includes most current homes and businesses in the community of Libby.

This SAP contains the elements required for both a field sampling plan (FSP) and quality assurance project plan (QAPP). This SAP has been developed in accordance with the Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA 2001), the Guidance on Systematic Planning Using the Data Quality Objectives Process – EPA QA/G4 (EPA 2006a), and the Site-Wide QAPP (CDM 2007). The SAP is organized as follows:

Section 1 - Introduction
Section 2 – Background and Problem Definition
Section 3 – Data Quality Objectives
Section 4 – Sampling Program
Section 5 – Laboratory Analysis and Requirements
Section 6 – Assessment and Oversight
Section 7 – Data Validation and Usability
Section 8 – Project Schedule
Section 9 – References

2.0 BACKGROUND AND PROBLEM DEFINITION

Libby is a community in northwestern Montana that is located near a large open-pit vermiculite mine. Vermiculite from this mine contains varying levels of a form of asbestos referred to as Libby Amphibole (LA). Historic mining, milling, and processing operations at the Site are known to have caused releases of vermiculite and LA to the environment that have caused a range of adverse health effects in exposed people, including not only workers at the mine and processing facilities (Amandus and Wheeler 1987, McDonald et al. 1986, McDonald et al. 2004), but also in residents of Libby (Peipens et al. 2003).

Starting in 2000, EPA began taking a range of cleanup actions at the Site to eliminate sources of LA exposure to residents and workers. In the early stages, efforts were focused mainly on wastes remaining at former vermiculite processing areas (the screening plant, export plant, etc.). As work progressed, attention soon shifted to cleanup of current homes and workplaces in Operable Unit 4. The protocol that EPA developed for investigating sources of LA at specific properties and deciding when to take action is detailed in a Technical Memorandum issued in December 2003 (EPA 2003a). Cleanup actions taken under this protocol typically include removal of unenclosed vermiculite insulation (VI) from any living spaces and any other readily accessible spaces (e.g., unfinished attics), removal of some or all contaminated outdoor soils, and may, in some cases, include cleanup of indoor dusts.

Problem Definition

One issue of high priority to EPA is an evaluation of the efficacy of the current cleanup strategy. That is, answers are needed for the following questions:

- At a property that EPA has investigated and found no reason to take any cleanup actions under the approach described in USEPA (2003a), are the risks that remain sufficiently small to be considered acceptable?
- At a property where EPA has investigated and determined that one or more sources was present that required cleanup under the approach described in USEPA (2003a), are the risks that remain after the cleanup is complete sufficiently small to be considered acceptable?

Note: For convenience, in this document, the phrase "**post-cleanup property**" will be used to indicate any property where EPA has investigated sources and has either taken cleanup action or else tentatively determined that no cleanup action is needed.

Residual exposures and risks that may remain at post-cleanup properties may be divided into two main types:

- Exposures that occur inside the building
- Exposures that occur outside the building

This SAP is focused on collection of the data needed to support an evaluation of the residual level of exposure and risk that may exist outside the building at post-cleanup properties. Collection of data needed to evaluate residual exposures and risks from exposures that occur inside the building at post-cleanup properties is addressed in a separate sampling plan (EPA 2007).

There are several different pathways by which residents and workers in OU4 might be exposed to residual LA contamination in outdoor soil. It is currently believed that the most important of these is inhalation of air in the immediate vicinity of an active soil disturbance that causes a release of LA fibers from soil into air. For convenience, measurement of asbestos in air in the immediate vicinity of an active soil disturbance is referred to as “activity-based sampling” (ABS).

<u>Overview of Existing Data</u>

EPA has collected some initial data on the levels of LA that occur in air in association with active disturbance of outdoor soil (EPA 2005). In brief, these data include ABS personal and stationary air samples that were collected in association with three types of outdoor soil disturbance scenarios (digging, mowing, and raking) at several different locations with varying levels of LA in the soil. Air samples were evaluated by TEM with an average sensitivity of about 0.001 s/cc. Soil samples were collected from the same location as the soil disturbance and these were evaluated by polarized light microscopy (PLM) in accord with site-specific SOPs that has been developed for use at Libby. This site-specific approach is referred to as PLM-VE. In this approach, soil levels are categorized semi-quantitatively into “bins”, as follows:

PLM-VE Bin	Meaning
A	Asbestos not detected
B1	Asbestos is detected at a level estimated to be ≤ 0.2%
B2	Asbestos is detected at a level estimated to be > 0.2% but < 1%
C	Asbestos is detected at a level estimated to be ≥ 1%

The initial data[1] are summarized in Figure 2-1. As seen, there is wide variability (4-5 orders of magnitude) in the levels of LA seen in ABS air. However, there is an apparent trend toward higher levels of LA in air as a function of increasing LA levels in soil (as indicated by PLM-VE measurements of the soil).

While informative, these initial data are not sufficient to support reliable risk assessment or risk management decisions for the outdoor soil disturbance scenario because of the following data limitations:

- Not enough samples have been collected to adequately limit statistical uncertainty
- Not enough samples have been collected to ensure adequate spatial and temporal (seasonal) representativeness of the data
- ABS locations where soil is characterized as "Bin A" (non-detect) by PLM-VE may actually represent a range of residual soil contamination levels, since some may be characterized by the absence of visible vermiculite, while others may be characterized by the presence of visible vermiculite. Additionally, the PLM-VE method, which has a practical quantitation limit of about 0.2% (wt) for LA, may simply not be sensitive enough to identify levels in soils that, when disturbed, generate asbestos levels in air that are of potential concern.

Thus, the primary problem that this SAP seeks to address is the lack of sufficient ABS outdoor air data in OU4 to support risk assessment and risk management decisions about risks from residual contamination in post-cleanup soils.

[1] These data have not yet been fully validated. Thus, the data should be considered tentative and revisions may occur.

3.0 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are statements that define the type, quality, quantity, purpose and use of data to be collected. The design of a study is closely tied to the DQOs, which serve as the basis for important decisions regarding key design features such as the number and location of samples to be collected and the chemical analyses to be performed. In brief, the DQO process typically follows a seven-step procedure, as follows:

1. State the problem that the study is designed to address
2. Identify the decisions to be made with the data obtained
3. Identify the types of data inputs needed to make the decision
4. Define the bounds (in space and time) of the study
5. Define the decision rule which will be used to make decisions
6. Define the acceptable limits on decision errors
7. Optimize the design using information identified in Steps 1-6

Following these seven steps helps ensure that the project plan is carefully thought out and that the data collected will provide sufficient information to support the key decisions which must be made. The following paragraphs implement the DQO process for this project.

3.1. State the Problem

EPA has been working to clean up both indoor and outdoor sources of VI, vermiculite-containing soil (VCS), and LA at properties in OU4. In order to help evaluate the efficacy and protectiveness of these cleanup activities, information is needed to characterize the level of residual risk from outdoor exposures that may remain at post-cleanup properties. Under the current approach (EPA 2003a), the triggers for cleanup (removal and replacement with clean fill) of outdoor soil are summarized below:

Mandatory Triggers (these conditions always trigger a soil clean-up in the location exceeding the trigger)

- Any visible vermiculite in a specific use area (SUA)
- Gross vermiculite visible in a non-SUA (NSUA) area (e.g. yard)
- Any location where PLM-VE $\geq$ 1%

Conditional Trigger (this condition does not trigger a clean-up of the area unless some other trigger for cleanup has been exceeded at the property)

- Any area where PLM-VE is > ND but < 1%

Based on these procedures, the types and levels of LA and vermiculite that may remain in outdoor soil at a post-cleanup property are summarized below:

Case	Potential Residual Sources in Outdoor Soil
1. No cleanup triggers were exceeded either indoors or outdoors; no action taken	- non-gross visible vermiculite in any non-SUA - PLM-VE < 1% in any area
2. One or more triggers were exceeded (either indoors and/or outdoors); cleanup action taken	- non-gross visible vermiculite in a yard (non-SUA) (PLM-VE = ND)

Based on this, the problem to be addressed in this SAP is to obtain sufficient ABS outdoor air data to determine if any of these residual sources of LA contamination in outdoor soil pose an unacceptable risk to human health.

3.2. Identify the Decisions

The data to be collected during this effort are intended to support the following decisions:

1) Is the current strategy for cleaning up outdoor soil in OU4 adequate to provide health protection from exposures that occur when residents disturb the soil?

> Note: The method that EPA currently recommends for estimating excess risk of lung cancer and mesothelioma from inhalation exposure to asbestos in air is described in IRIS (2007). This method is currently undergoing review, and the approach may be revised in the future as new methods are developed and as new toxicity data on asbestos are obtained. In addition, the EPA has not yet developed a method for assessing non-cancer risks from inhalation exposure to asbestos. Thus, it is important to stress that all evaluations of protectiveness that are based on currently available risk assessment methods should be viewed as interim, and these interim decisions may be revised in the future as methods and data for assessing the cancer and non-cancer risks of asbestos are improved.

2) If not, what characteristics of the soil (e.g., presence of visible vermiculite and/or PLM-VE result) can be used to recognize areas that require further clean-up?

3.3. Identify the Types of Data Needed

The data needed to achieve the objectives of this effort consist of accurate and reliable measures of LA in outdoor air during ABS activities at different locations characterized by a range of residual levels of LA in soil. The following sections identify key attributes of the data needed for this effort.

Soil Categories

Based on the current protocol for cleanup actions at a property, yards (or sub-parts of yards) at post-cleanup properties may be categorized into five types, as follows:

Soil Category	Residual Source	
	PLM-VE Analysis for LA	Visual Presence of Vermiculite
1	None (clean fill has been added)	
2	Bin A (ND)	No
3	Bin A (ND)	Yes
4	Bin B1 (<0.2%)	Either Yes or No
5	Bin B2 (0.2% - 1%)	Either Yes or No

In order to determine if these categories of residual soil contamination may pose an unacceptable human health risk, the locations (yards or parts of yards) investigated by ABS in this SAP must include a number of examples of each soil category. This stratification will also help increase the ability to determine if a clear exposure-response relationship can be detected.

Clean fill is used as a point of reference against which the other four categories of soil may be evaluated. Greatest emphasis is placed on stratification of soils that contain low levels of LA (ND by PLM-VE), since these soils are generally left in place. Stratification of areas with higher levels by PLM-VE is considered less important because most of these soils are presently cleaned up under the current strategy.

Whenever possible, locations for outdoor ABS testing will be selected from post-cleanup properties. However, if an adequate number of sampling locations can not be located, then appropriate locations that meet the bin definitions above may be selected from other properties.

Types of Air Samples

Experience at Libby and at other sites has demonstrated that, in general, personal air samples (i.e., samples that collect air in the breathing zone of a person) tend to be higher than air samples collected by a stationary monitor, especially if the person is engaged in an activity that disturbs an asbestos source such as contaminated soil. Because of this, this SAP will focus on the collection of personal air samples during ABS.

Target Analyte List

Each air sample that is collected must be analyzed for asbestos particles. Specific methods and counting rules are provided in Section 5. Results should include the size (length, width) of each particle, along with the mineral classification (LA, other amphibole, chrysotile).

Types of Soil Disturbances

Residents may disturb soil in their yards by a wide variety of different activities. Conceptually, the ideal data set would include ABS data from many different types of disturbance that span the full range of intensities that may occur under residential land use. However, it is not feasible to evaluate every possible type of disturbance. Rather, this assessment will focus on three standardized scenarios which are considered to be realistic examples of relatively vigorous disturbances:

- Raking the lawn or yard with a metal-tined leaf rake
- Mowing the yard with a gasoline powered rotary lawn mover
- Digging in the soil with a shovel and pail (simulating a child's play)

Soil Condition Data

It is expected that the amount of dust (and asbestos) released from an ABS event may depend in part on the condition of the soil at the time of the ABS event. In order to help characterize this source of variability, and potentially to allow for some degree of normalization between locations, the following data items are needed for each ABS test area:

- Nature and extent of soil vegetative cover (documented in field notes and photographs)
- Real-time aerosol monitors (RAMs) set up in the immediate proximity of the ABS disturbance to measure dust levels in air (ug/m^3)
- Soil moisture

3.4. Define the Bounds of the Study

Spatial Bounds

The spatial bounds of this study are restricted to post-cleanup properties located within OU4 of the Libby Superfund Site. This OU includes most current residential and commercial properties in the community. Note, however, that the results of this study may also be useful in assessing cleanup efficacy under similar conditions in other operable units at the Site.

Temporal Bounds

Estimation of human health risk from exposure to LA in outdoor air following a series of active outdoor soil disturbances is based on the average concentration that occurs across the series of disturbances. Because the level of LA in outdoor ABS air may depend on factors that vary seasonally (disturbance patterns, soil moisture, wind speed, humidity, etc.), the data set needed for this effort should ideally consist of multiple samples from each area, spanning a range of time points and meteorological conditions. This will help ensure that reliable estimates of long-term average concentrations may be computed from the individual short-term measurements. The exact dates of ABS sampling are not important and may be selected at random (since the goal is to capture temporal variability). However, all samples collected in the summer of 2007 should be collected under conditions when the soil is relatively dry (less than 1/10-inch of rain within the past 36 hours), and a field moisture deficiency of at least 50% (see Section 4.2.2, below), to help ensure that the data are not biased low. For samples collected in the spring of 2008, ABS sampling should not occur if rainfall has exceeded ¼ inch in the past 36 hours.

3.5. Define the Decision Rule

The decision rule for evaluating residual risks from disturbance of outdoor soils at post-cleanup properties is:

> If the level of risk to humans from exposure to ABS air at a post-cleanup location, when combined with the level of risk which applies to the same individuals from other applicable exposure pathways, does not exceed a cancer risk of 1E-04 or a non-cancer Hazard Quotient of 1.0, then risks at that location will be considered acceptable. If the total risk exceeds a cancer risk of 1E-04 or an HQ of 1.0, then the feasibility of further reducing exposure from either the outdoor soil disturbance pathway and/or the other applicable exposure pathways at that location shall be assessed.

At present, EPA has not developed a quantitative procedure for evaluating non-cancer risks, but has developed a method for quantification of cancer risk (IRIS 2007). The basic equation is:

$$\text{Risk}(i) = C(i) \cdot TWF(i) \cdot UR(i)$$

were:

Risk(i) = Risk of dying from a cancer that results as a consequence of exposure from specified exposure scenario "i"

C(i) = Average concentration of asbestos fibers in air (f/cc) during exposure scenario "i"

UR(i) = Unit Risk $(f/cc)^{-1}$ that is appropriate for exposure scenario "i"

TWF(i)= Time weighting factor for exposure scenario "i". This factor accounts for less-than-continuous exposure during the exposure interval.

Because each person can be exposed from more than one source, the total cancer risk is calculated by summing the risks from each exposure pathway that applies:

$$\text{Total risk} = \Sigma\ \text{Risk(i)}$$

As noted above, this document is focused on collection of data on the concentration of asbestos that occur in the breathing zone of people who are engaged in activities that disturb outdoor soil. These data will be used to evaluate the risk from the soil-disturbance pathway. This risk estimate will, in turn, be combined with risk estimates for other pathways to estimate total exposure.

As noted above, because of limitations in the current methods for assessing risks from asbestos, all decisions regarding residual risk levels are considered interim, and interim decisions may be revisited in the future as new methods and new data become available.

3.6. Define the Acceptable Limits on Decision Errors

In making decisions about the long-term average concentration of LA in outdoor ABS air and the level of health risk associated with that exposure, two types of decision errors are possible:

- A false negative decision error would occur if a risk manager decides that exposure to ABS air is not of significant health concern, when in fact it is of concern.

- A false positive decision error would occur if a risk manager decides that exposure to ABS air is above a level of concern, when in fact it is not.

EPA is most concerned about guarding against the occurrence of false negative decision errors, since an error of this type may leave humans exposed to unacceptable levels of LA in indoor air. For this reason, it is anticipated that decisions regarding this pathway will be based not only on the best estimate of the long term average concentration, but will also consider the 95% upper confidence limit (UCL) of the long-term average concentration. Use of the UCL to estimate exposure and risk helps account for limitations in the data, and provides a margin of safety in the risk calculations, ensuring that risk estimates are unlikely to be too low.

EPA is also concerned with the probability of making false positive decision errors. Although this type of decision error does not result in unacceptable human exposure, it may result in unnecessary expenditure of resources. For the purposes of this effort, the strategy adopted for controlling false positive errors is to set a goal that, if the exposure estimate based on the 95% UCL is above EPA's level of concern for this pathway, then the UCL is not larger than 3-times the best estimate of the mean. If the 95% UCL is at or above the range that is of potential concern, and the UCL is greater than 3 times the best estimate of the mean, then it will be concluded that there is a substantial probability of a false positive decision error and that more data may be needed to strengthen decision-making.

3.7. Optimize the Design

Limiting the Uncertainty in Estimates of Long-Term Average Concentration

The method used to compute the UCL of a set of indoor air samples depends on the statistical properties of the data set. For samples from the Libby Site, the data are believed to be reasonably well represented by a Poisson lognormal (PLN) distribution, and the parameters of the PLN can be derived using a fitting procedure described by Haas et al. (1999). The fitted parameters (μ and σ) may then be used to compute the UCL of the mean using the approach for lognormal data sets described in EPA (1992). Based on this approach, the ratio of the UCL to the mean of a data set (an indication of the statistical uncertainty in the data) is given by:

$$\frac{UCL}{Mean} = \exp\left(\sigma H / \sqrt{(n-1)}\right)$$

where:

σ = log standard deviation of the measured values
H = statistic described in USEPA (1992)
n = number of samples

Figure 3-1 illustrates the ratio of the UCL to the mean as a function of n for an assumed value of σ of 2.0 (geometric standard deviation = 7.4). As seen, the ratio (a measure of uncertainty) approaches a value of about 2 as the number of samples approaches about 80-100, and continues to decline slowly as the number of samples increases. Based on this analysis, it is expected that if a total of about 80-100 samples per soil type were collected, the uncertainty in the average

ABS air concentration for that soil type would be limited to less than a factor of 3, and that collection of additional samples would result in only minor decreases in uncertainty. Because three different types of ABS samples will be collected per soil location at each of two different times, if there were 15 locations per soil category, this would result in a total of 3 x 2 x 15 = 90 measurements per soil category, which should result in an acceptable limit on the width of the uncertainty bounds around the long-term average ABS air value for the soil category.

Estimating the Required Analytical Sensitivity for Outdoor Air

For the purposes of this effort, the analytical sensitivity that is needed for analysis of ABS air samples should be sufficient to ensure reliable detection and quantification if risks from outdoor activity-based sampling (ABS) air approach or exceed a level of health concern. The choice of the level of concern is complicated by the fact that residents and workers in Libby may be exposed to asbestos by more than one pathway, and hence risk management decisions must consider the total (cumulative) risk from all pathways combined. With this in mind, the target level of concern for the outdoor ABS pathway alone is set at a cancer risk of 1E-05 (1 in 100,000) or a non-cancer HQ of 0.1. That is, the target sensitivity is selected such that, if the true concentration of LA in outdoor ABS air corresponds to a risk that could contribute risk 1/10 the total level of concern (1E-04), the concentrations in air would be readily detectable and quantifiable with good confidence. If the true concentration corresponds to a risk that is less than 1/10 the total level of concern, exact quantification of the pathway becomes less important.

The concentration of LA in outdoor ABS air that is associated with a risk level of 1E-05 is derived from the basic risk equations described above, simply by solving for the concentration that yields a risk of 1E-05:

$$1\text{E-}05 = C(air) \cdot TWF \cdot UR$$
$$C(air) = 1\text{E-}05 / (TWF \cdot UR)$$

Note that the type of fibers included in this concentration is defined by the risk model. For example, the current EPA approach is based on phase contrast microscopy (PCM) fibers, which are defined as asbestos fibers longer than 5 um, thicker than 0.25 um, and with an aspect ratio greater than 3:1. For convenience, the fibers used in a risk model are called “risk-based fibers”.

In most cases, the risk-based fibers are only a sub-set of the total asbestos fibers present in air. The fraction of fibers that are risk-based is referred to as the “risk-based fraction” (RBF):

$$RBF = C(\text{risk-based}) / C(\text{total})$$

At the Libby site, current analytical methods focus on measuring the concentration of total fibers, and sufficient data have accumulated to estimate the RBF with good accuracy. Thus, the concentration of risk fibers may be calculated from a measure of total fibers as follows:

$$C(\text{risk=based}) = C(\text{total}) \cdot RBF$$

This approach provides an estimate of the concentration of risk-based fibers that has lower statistical uncertainty than if only risk-based fibers were measured, and may be applied to any risk model that may be of interest.

Combining these two equations and rearranging to solve for the concentration of concern associated with a specified risk level (1E-05) for this exposure scenario yields the following:

$$\text{Concentration of Concern (Total TEM s/cc)} = (1E\text{-}05) / (RBF \cdot TWF \cdot UR)$$

For planning purposes, it is conservatively assumed that the TWF for exposure to ABS air is 0.04. This value would correspond to an outdoor soil disturbance frequency of 8 hrs/day, 60 days/yr for 50 years. It is considered likely that most residents will have soil disturbance exposures that are considerably less than this assumption, although this value might be realistic for some types of tradespersons whose work regularly involves outdoor yard or soil disturbance activities.

Based on EPA's currently recommended cancer risk model (IRIS 2007), the unit risk factor for lifetime exposure is 0.23 per PCM(E) f/cc. Based on particle size data from the Libby Site, the fraction of total LA fibers in air that are PCME fibers is about 0.45. Thus, the concentration of concern for total LA in outdoor ABS air would be about:

$$\text{Concentration of cancer concern (1E-05 risk level)} = (1E\text{-}05) / (0.04 \cdot 0.45 \cdot 0.23) = 0.0024 \text{ s/cc}$$

As noted previously, this concentration of concern may be revised in the future as methods and data for asbestos cancer risk evaluation are improved. In order to at least partially account for potential future changes, the target analytical sensitivity for evaluating cancer risk is set to a somewhat lower value of 0.001 cc^{-1}.

For non-cancer effects, the basic risk equation is:

$$HQ = C \bullet (ET/24 \bullet EF/365 \bullet ED) / RfC$$

where:

HQ = hazard quotient (dimensionless)
C = long-term average concentration of asbestos in air (f/cc), expressed in the same units as used in the reference concentration (RfC)

ET = exposure time (hrs/day)
EF = exposure frequency (days/yr)
ED = exposure duration (yrs)
RfC = reference concentration (f/cc-yrs)

EPA toxicologists are currently working to develop an RfC for asbestos based on available data on LA and other forms of asbestos, but at present, no value has been finalized or approved for use. Therefore, it is not yet possible to compute an analogous level of concern for this endpoint. In the absence of data, it is tentatively assumed that the target analytical sensitivity that is adequate for evaluating cancer risk will also be sufficient for evaluating non-cancer risks. This assumption will be re-visited when an RfC is approved for use.

Assuming that most ABS samples will be collected in the field on filters that are 385 mm^2 and that the collection volume is about 1,200 L (120 minutes x 10 L/min), the number of grid openings (GOs) that will require analysis in order to achieve a target analytical sensitivity of 0.001 cc^{-1} is about 30. However, if the soil disturbance results in high dust levels in air, the filter may be overloaded, requiring an indirect preparation. In this case, the number of GOs needed to achieve the target sensitivity may be 3 to100 fold higher. In the event that the number of grid openings requiring analysis becomes time- or cost-prohibitive, it is generally better to increase the analytical sensitivity somewhat (e.g., 0.002 or 0.003 cc^{-1}), rather than decrease the number of samples collected and analyzed (EPA 2007).

<u>Refinements to the Design as Data are Collected</u>

In accord with EPA's DQO process, it is expected that the ABS program described in this document may be modified periodically as data are obtained. For example, if data suggest that there is little variability as a function of season, then EPA may decrease the number of sampling events over time. Alternatively, if data suggest that the variability in concentrations is higher than expected, then additional samples may be added to better limit the uncertainty in the values. Similarly, the target analytical sensitivity may be either increased or decreased, depending on the detection frequency, mean values, and sample variability observed in initial samples results, and on the RfC value when it becomes available. Finally, the design may be revised if new methods for evaluating cancer or non-cancer effects are developed and approved for used by EPA.

4.0 SAMPLING PROGRAM

The following sections summarize field activities that CDM will perform during the outdoor ABS investigation. All activities will be performed in accordance with this SAP. Field personnel will refer to the Site-Wide Quality Assurance Project Plan (SWQAPP) (CDM 2007) sections listed below for details regarding requirements referenced in this SAP:

SWQAPP Section Number	Section Title
3.1	Sample Collection
3.2.1	Drafting and Approval of Governing Documents
3.2.2	Field Planning Meetings
3.2.3	Field Team Training Requirements
3.2.4	Field Logbooks
3.2.5	Field Sample Data Sheets (FSDSs)
3.2.6	Investigation Specific Field Forms
3.2.7	Photographic Documentation
3.2.8	Global Positioning System (GPS) Point Collection
3.2.9	Field Equipment Maintenance
3.2.10	Handling IDW
3.2.11	Field Sample Custody and Documentation
3.2.12	Sample Packaging and Shipping
3.2.13	Modification Forms
3.2.14.1	Field Surveillances
3.2.14.2	Field Audits

The SOPs and site-specific procedures to be utilized during this sampling event are listed below and included in Attachment A:

- Sample Custody (SOP 1-2)
- Packaging and Shipping of Environmental Samples (Modified SOP 2-1)
- Guide to Handling of Investigation-Derived Waste (Modified SOP 2-2)
- Field Logbook Content and Control (Modified SOP 4-1)
- Photographic Documentation of Field Activities (Modified SOP 4-2)
- Field Equipment Decontamination at Nonradioactive Sites (Modified SOP 4-5)

- Control of Measurement and Test Equipment (SOP 5-1)
- Sampling of Asbestos Fibers in Air (EPA-LIBBY-01)
- Site-Specific Standard Operating Procedures for Soil Sample Collection (CDM-LIBBY-05, Revision 2)
- Site-Specific Standard Operating Procedure for Semi-Quantitative Visual Estimation of Vermiculite in Soil (CDM-Libby-06, Revision 1) with modifications

4.1 Pre-Sampling Activities

Prior to beginning field activities, sampling locations will be selected, community coordination will be conducted (owners will be contacted to determine their willingness to participate in the program), a field planning meeting will be conducted, any required trainings will be conducted, and an inventory and procurement of supplies will be performed.

4.1.1 Selection of Sampling Locations

As discussed in Section 3.3, it is important that the locations selected for ABS be representative of the types and levels of residual sources that may remain at post-cleanup locations. The five soil categories that may exist at a property are:

<table>
<tr><th rowspan="2">Soil Category</th><th colspan="2">Residual Source</th></tr>
<tr><th>PLM-VE Analysis for LA</th><th>Visual Presence of Vermiculite</th></tr>
<tr><td>1</td><td colspan="2">None (clean fill)</td></tr>
<tr><td>2</td><td rowspan="2">ND (Bin A)</td><td>No</td></tr>
<tr><td>3</td><td>Yes</td></tr>
<tr><td>4</td><td>Bin B1</td><td>Either Yes or No</td></tr>
<tr><td>5</td><td>Bin B2</td><td>Either Yes or No</td></tr>
</table>

The target number of homes in each category is 15 (75 total). To the extent possible, the 15 locations in each soil category will be selected to provide a reasonable spatial representation in OU4. In order to achieve this objective, the list of all post-cleanup properties in OU4 will first be stratified according to the presence of the five soil categories above, and then into three different sub-areas (north, central, and south), as shown in Figure 4-1. CDM's Community Involvement Coordination (CIC) staff will then contact the residents at the properties in each category in each sub-area to determine if they are willing to participate in this investigation. The objective is to obtain about equal number of locations from residents in each sub-area for each soil category. Also, to the extent possible, the number of locations for Soil categories 4 and 5 will be divided approximately evenly between the presence and absence of visible vermiculite.

When outdoor ABS activities are conducted at a property where indoor ABS is also planned, the indoor activities will be completed on a different day than the outdoor activities, with a preference for the indoor to occur before the outdoor activities whenever possible.

4.1.2 Community Coordination

A CDM CIC will contact each resident to describe the program and the potential impact to the resident (e.g., requirements for temporary relocation and the expected duration of the program). The property owner will be advised of the study's duration, sampling frequency, and will be informed of the importance of obtaining samples consistently over that extended time period. The property owner will have the opportunity to accept or decline their participation in this investigation before sampling is started on their property under this SAP. Upon acceptance, the property owner will receive an access agreement to sign. Access agreements will be obtained prior to the start of sample collection. Property-specific background information will also be collected by the CIC on the ABS investigation form included in Attachment A. If information collected on the ABS investigation form is inconsistent with data collected during previous investigations, the current override system of updating property information in the project database (Libby2) will be used.

4.1.3 Field Planning Meeting

A field planning meeting will be conducted in accordance with the procedures detailed in Section 3.2.2 of the SWQAPP (CDM 2007).

4.1.4 Training Requirements

Training requirements described in Section 3.2.3 of the SWQAPP (CDM 2007) will apply to personnel conducting sample collection activities described in this SAP.

4.1.5 Inventory and Procurement of Equipment and Supplies

The following equipment are needed for sampling activities, and any required equipment not already contained in the field equipment supply inventory will be procured prior to initiation of sampling activities:

- Field logbooks
- Indelible ink pens
- Digital camera
- Video camera
- Sample cassettes: 0.8 um pore, 25 mm diameter mixed-cellulose ester (MCE) filter cassettes
- Sample paperwork and sample identification (ID) labels

- Custody seals
- Zipper-top baggies
- Air sampling pumps
- Tygon tubing
- Rotameters
- Personal protective equipment (PPE) as required by the HASP
- DataRAM
- Portable MET Station

4.2 Sample Collection

As noted above, the goal is to collect ABS samples for three different disturbance activities at each of two different time points for each of 15 different locations for each of five different soil categories (total = 450 samples). The following sections describe the sample collection procedure for each sampling event.

4.2.1 Outdoor Air Sampling

Sampling will occur over a 6-hour time interval, divided into three sub-periods of 2-hours each with air samples collected separately for each 2-hour sub-period. The activities to be conducted include the following:

- Period 1 – lawn-mowing
- Period 2 – raking
- Period 3 – child play

Each of the activities will be conducted in accordance with EPA's Emergency Response Team (ERT) SOP #2084, Activity-Based Air Sampling for Asbestos, with project-specific modifications (Attachment 1).

4.2.1.1 Personal Air Samples

Personal air samples will be collected from the breathing zones of the event participants in accordance with EPA-LIBBY-01, provided in Attachment A. The breathing zone can be visualized as a hemisphere approximately 6 to 9 inches around an individual's face. Personal air samples will be collected at two flow rates using two different types of pumps during each two-hour event, with a new sample started at the beginning of each new period. The flow rates for sample collection should be 10 and 3.5 liters per minute resulting in target volumes of 1,200 and 420 liters, respectively. These flow rates were chosen for this sampling event in order to maximize the volume of air collected which in turn helps achieve the analytical sensitivities required for risk assessment evaluations. For all asbestos sampling, an asbestos sampling train consisting of 0.8-micron (µm), 25-millimeter (mm) mixed cellulose ester (MCE) filter connected to a sampling pump will be used. The top cover from the cowl extension on the sampling cassette shall be removed ("open-face") and the cassette oriented face down.

Both the high volume and low volume samples will be submitted to the laboratory for analysis. If the higher volume sample is not readable by transmission electron microscopy (TEM) after a direct preparation method, either the lower flow sample may be evaluated for analysis by direct preparation, or the higher flow sample may be used by applying an indirect sample preparation technique. *The laboratory must consult with EPA in order to select which is the most appropriate approach to follow.*

If it is necessary to relieve a participant from an activity, a relief (backup) participant will be properly suited in time to make the exchange. When the relief participant is ready, the activity participant will stop, remove the backpack or belt, pass it to the relief participant, and assist the relief participant with donning and adjusting the backpack or belt. The exchange is anticipated to take less than 60 seconds, so the sampling pumps and event time clock will not be halted during the exchange. If the exchange requires more than 60 seconds, the pump and event clock will be stopped until activity is re-initiated.

4.2.1.2 Pump Fault and Flow-Rate Error Procedures

Pump flow rates will be verified at 30 minute intervals or when participants are relieved from an activity by a backup participant, whichever occurs sooner. If at any time the observed flow rates are ±10% of the target rate, the sampling pump should be re-calibrated. If at any time an air sampling pump is found to have faulted or the observed flow rates are 30% below or 50% above the target rate, Figure 4-2 should be consulted to determine the next appropriate action. The time elapsed from the start of the activity until the fault/flow observation will be used to determine the appropriate action according to Figure 4-2.

To calculate the percentage of an observed flow to the target flow, the following formula is used:

$$X\% = \frac{Observed\ Flow\ Rate\ (L/min)}{Target\ Flow\ Rate\ (L/min)} \cdot 100$$

Figure 4-2 Procedures for Pump Fault and Flow-Rate Errors

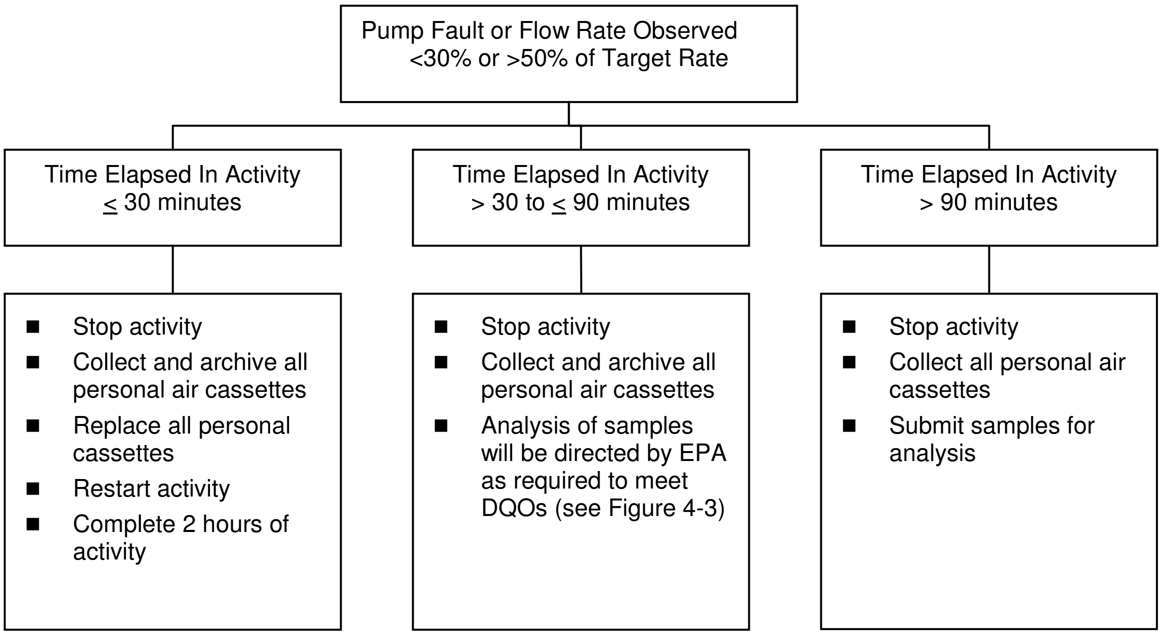
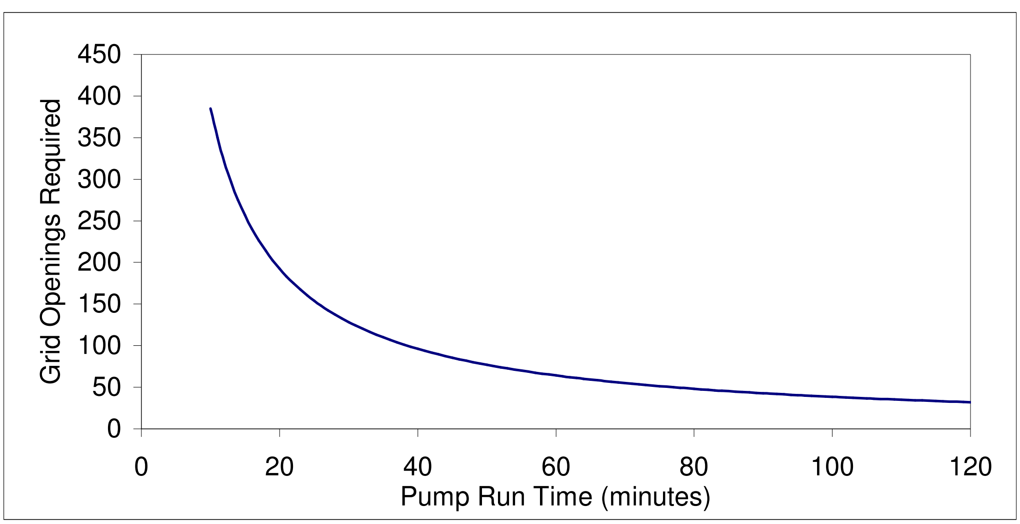


Figure 4-3 (below) illustrates the number of grid openings that will require analysis to achieve the target sensitivity (0.001 cc^{-1}) when there is a pump fault and the collection time is less than target (2 hours).

Figure 4-3. Effect of Pump Time on Grid Openings Required



4.2.1.3 MET Station Data

A portable meteorological (MET) weather station will be deployed to record parameters representative of the study area. The following parameters will be recorded every 30 seconds during each event: wind speed, wind direction, relative humidity, temperature, and barometric pressure. The meteorological station should be placed close enough to the activities so the observations of the MET station reflect the conditions of the activity area. Copies of all MET station data will be provided to EPA and SRC within one week after collection. Electronic copies have been determined to be suitable and will be placed in the project e-room.

4.2.1.4 RAM Data

One DataRAM 4™ or equivalent will be place immediately next to each ABS scenario area in the dominant downwind direction. The DataRAM will be programmed to log the observed concentration of particulates 0.1 um and larger every 5 seconds. Data will be downloaded daily and copies of all DataRAM data will be provided to EPA and SRC within one week after collection. Electronic copies have been determined to be suitable and will be placed in the project e-room.

4.2.2 Outdoor Soil Sampling

The area where ABS activities is performed will be delineated with stakes, pin flags, or equivalent visual markers. At each ABS sampling location included in this effort, one 30-point composite soil sample will be collected from each scenario area. The soil samples will be collected so that the entire ABS area is represented by the sample. Soil samples will be collected and homogenized in accordance with the Site-Specific Standard Operating Procedures for Soil Sample Collection (CDM-LIBBY-05, Revision 2) except that the soil will not be wetted with water before collection.

In order to ensure that sufficient sample is available for potential future investigations, the mass of the composite sample must be no less than 2.0 kg.

A sketch of the outdoor yard will also be prepared to indicate the approximate locations and size of the ABS scenario area. The sketch should indicate the soil condition at the ABS location, including the extent of vegetative cover and any other important visual features. The sketch should also indicate the approximate location and level of any visible vermiculite in the yard, and the approximate boundary of the area selected for the ABS area(s). This should be done in accordance with the Site-Specific Standard Operating Procedure for Semi-Quantitative Visual Estimation of Vermiculite in Soil (CDM-LIBBY-06, Revision 1) with the following modifications:

- All areas of the property will be divided into zones and inspected for visual vermiculite regardless of previous excavations or presence of LA
- Interior surfaces (e.g., crawlspace, shed floor) will not be inspected for visual vermiculite
- Semi-quantitative estimates of vermiculite observed during sample collection will be recorded on FSDS and not on the Visual Vermiculite Estimation Form.

Outdoor soil sampling and observations shall occur close to the time that the outdoor air samples are collected. If these cannot be carried out in sequence (within the same 24-hour period), the field team should prepare a temporary modification form.

Soil moisture will be estimated for each ABS scenario area by the hand appearance method that provides results in percent of field capacity. This is performed by firmly squeezing a handful of soil and comparing the results to the table below. For each ABS area soil used for this evaluation should be collected from the center of the area and be from 0 to 2 inches below ground surface. ABS activities will not be performed if the soil moisture deficiency is less than 50%.

Field Test for Moisture Content – Interpretation Table			
% Soil Moisture Deficiency	**Moderately coarse texture**	**Medium texture**	**Fine and very fine texture**
0 (field capacity)	Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.		
0 to 25	Forms weak ball, breaks easily when bounced in hand.*	Forms ball, very pliable, slicks readily.*	Easily ribbons out between thumb and forefinger.*
25 to 50	Will form ball, but falls apart when bounced in hand.*	Forms ball, slicks under pressure.*	Forms ball, will ribbon out between thumb and forefinger.*
50 to 75	Appears dry, will not form ball with pressure.*	Crumbly, holds together from pressure.*	Somewhat pliable, will ball under pressure.*
75 to 100	Dry, loose, flows through fingers.	Powdery, crumbles easily.	Hard, difficult to break into powder.
*Squeeze a handful of soil firmly to make ball test.			

In addition to estimating soil moisture content in the field, 10% of soil samples submitted for asbestos analysis will also be analyzed for moisture content using ASTM Method D2216-05:

Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

4.3 General Processes

4.3.1 Equipment Decontamination

Decontamination of air sampling pumps and soil sampling equipment will be conducted as described in Sections 3.1.1.2 and 3.1.3.2 of the SWQAPP (CDM 2007). Equipment used during activities will be decontaminated after each use as described in ERT SOP #2084 with project-specific modification.

4.3.2 Sample Labeling and Identification

Sample index identification numbers will identify the samples collected during this study by having the following format:

EX-#####

Where: EX = Exterior Activity Based Sampling
= a sequential five digit number

4.3.3 Videotape Documentation

A videotape will be prepared to document a representative example of each scenario including any special conditions or circumstances that arose during the activity.

4.3.4 Field Logbooks

Field logbooks will be completed and managed as described in Section 3.2.4 of the SWQAPP (CDM 2007). CDM SOP 4-1, Field Logbook Content and Control including project-specific modification is provided in Attachment A. Copies of all logbook entries will be provided to EPA and SRC within one week of collection. Electronic copies are suitable and will be placed in the project e-room within one week after the completion of each sampling event.

4.3.5 FSDSs

FSDSs will be completed and managed as described in Section 3.2.5 of the SWQAPP (CDM 2007). Attachment B contains copies of the specific FSDSs that will be used to record information for samples collected during the activities described in this SAP. Copies of FSDSs will be provided to EPA and SRC within one week of collection. Electronic copies are suitable and will be placed in the project e-room within one week after the completion of each sampling event.

4.3.6 Photographic Documentation

Photographs will be collected, documented, and managed as described in Section 3.2.7 of the SWQAPP (CDM 2007). CDM SOP 4-2, Photographic Documentation of Field Activities including project-specific modification is provided in Attachment A. Photographs will be used to document areas where outdoor activities are conducted. File names will be in the format:

last name of property owner_address_EABS_date , where:

EABS = Exterior Activity Based Sampling

Date = MM_DD_YY

4.3.7 GPS Point Collection

GPS location coordinates will be collected as described in Section 3.2.8 of the SWQAPP (CDM 2007) and in accordance with CDM-LIBBY-09, provided in Attachment A. As related to the activities described in the SAP, one set of coordinates will be collected from the center of each scenario area. These coordinates will also represent the GPS coordinates associated with soil samples collected from the area. GPS coordinates will also be collected for the MET station.

4.3.8 Field Equipment Maintenance

Air sampling pump calibrations will be conducted and documented as described in Section 3.1.1.2 of the SWQAPP (CDM 2007). Field equipment maintenance will be conducted and documented as described in Section 3.2.9 of the SWQAPP (CDM 2007). CDM SOP 5-1, Control of Measurement and Test Equipment, is provided in Attachment A.

4.3.9 Handling Investigation Derived Waste (IDW)

Investigation derived waste will be managed as described in Section 3.2.10 of the SWQAPP (CDM 2007). CDM SOP 2-2, Guide to Handling of IDW, including a project-specific modification is provided in Attachment A.

4.3.10 Field Sample Custody and Documentation

Field Sample Custody and documentation will follow the requirements described in Section 3.2.11 of the SWQAPP (CDM 2007). CDM SOP 1-2, Sample Custody, including a project-specific modification is provided in Attachment A. Copies of all COCs will be provided to EPA and SRC within one week of collection. Electronic copies are suitable and will be placed in the project e-room within one week after the completion of each sampling event.

4.3.11 Sample Packaging and Shipping

Sample packaging and shipping will follow the requirements described in Section 3.2.12 of the SWQAPP (CDM 2007). CDM SOP 2-1, Packaging and Shipping of Environmental Samples, including a project-specific modification is provided in Attachment A.

4.3.12 Modification Forms

All deviations will be documented and recording according the requirements described in Section 3.2.13 of the SWQAPP (CDM 2007).

4.3.13 Field Surveillances and Audits

Field surveillances and audits will be conducted according to the requirements described in Section 3.2.14 of the SWQAPP (CDM 2007).

4.4 QA/QC Activities

The QA/QC actions required for each process described in this SAP will follow the requirements described in the SWQAPP (CDM 2007).

Collection of QA/QC Field Samples

QA/QC samples will be collected according to the procedures described in the SWQAPP (CDM 2007). All QA/QC field samples will be collected at the frequencies described in the SWQAPP with the exception of the frequency of drying blanks and field blanks for air samples. It is expected that drying air sample cassettes will not be required for this activity. One field blank will be collected at each property where activities are conducted. All field blanks collected as part of this program will be analyzed by counting a number of grid opens that is approximately equal to the number of rid openings that are analyzed for field samples. Table 4-1 summarizes the QA/QC sample collection and analysis frequencies for the outdoor ABS investigation.

5.0 LABORATORY ANALYSIS AND REQUIREMENTS

All laboratories that analyze samples collected as part of this project must participate in and have satisfied the certification requirements in the last two proficiency examinations from the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program (NVLAP). The laboratory must also analyze performance evaluation samples when requested. These analyses must be performed to confirm laboratory capabilities before any samples are submitted to the laboratory and may be subsequently submitted at regular intervals. In addition, the laboratory must participate in the laboratory training program developed by the Libby laboratory team.

5.1 Analytical Methods

Air

All outdoor air samples will be submitted to a subcontracted laboratory for analysis using the International Organization for Standardization (ISO) transmission electron microscopy (TEM) method 10312, also known as ISO 10312:1995(E) (CDM 2005c), with all applicable project specific modifications, including LB-000016, LB-000019, LB-000028, LB-000029, LB-000029a, LB-000030, LB-000053, and LB-000066a. All asbestos structures (including not only Libby amphibole but all other asbestos types as well) that have appropriate diffraction patterns and EDS spectra, and having length greater than or equal to 0.5 um and an aspect ratio ≥ 3:1, will be recorded on the Libby site-specific laboratory data sheets and electronic deliverables.

As described in the latest version of laboratory modification LB-000029, the frequency for laboratory-based QC samples for TEM analysis is:

Lab blank = 4%
Recount same = 1%
Recount different = 2.5%
Re-preparation = 1%
Verified analysis = 1%
Inter-laboratory = 0.5%

Soil

All soil samples collected as part of this effort will be analyzed for asbestos by polarized light microscopy (PLM-VE) in accord with SOPs SRC-LIBBY-01 (Revision 2) and SRC-LIBBY-03 (Revision 2).

A random subset of about 10% of all soil samples collected as part of this outdoor ABS effort will be analyzed for soil moisture content and particle size in accord with ASTM D2216-05: *Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass* and ASTM Method D6913-04e1: *Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis* or ASTM D422-63 (2002): *Standard Test Method for Particle-Size Analysis of Soils.*

Sample Archival

All air samples will be distributed to a project laboratory for analysis. Both the high volume and low volume samples will be sent to the same laboratory. Once analyzed, all samples will be stored (archived) at the laboratory under COC until further notice.

Aliquots of soil samples not sent for immediate analysis will be archived at the Soil Preparation Laboratory in accord with standard practice, as detailed in the latest version of the Close Support Facility Soil Preparation Plan.

5.2 Analytical Sensitivity for TEM Analyses

Outdoor Air Samples

As discussed in Section 3.7 (above), the target analytical sensitivity for outdoor ABS air samples is 0.001 s/cc. In the event of sample loading or other issues where an analytical sensitivity of 0.001 s/cc can not be achieved, the laboratory may report a sample result with a higher (poorer) sensitivity only after consultation with EPA project personnel and preparation of a temporary modification form.

5.3 Holding Times

No preservation requirements or holding times are established for air or soil samples collected for asbestos analysis.

5.4 Laboratory Custody Procedures and Documentation

Laboratory custody procedures and documentation will be completed as required by the specifications detailed in Section 4.5 of the SWQAPP (CDM 2007).

5.5 Documentation and Records

Laboratory documentation and records will be completed as required by the specifications detailed in Section 4.7 of the SWQAPP (CDM 2007).

5.6 Data Management

Sample results data will be delivered to the Volpe Center and CDM's Cambridge office both in hard copy and as an electronic data deliverable (EDD) in the most recent project-specific format. Electronic copies of all project deliverables, including graphics, will be filed by project number. Electronic files will be routinely backed up and archived according to individual laboratory processes.

All results, field data sheet information, and survey forms will be maintained in the Libby project database managed by the Volpe Center under the oversight of the Volpe Center database management team.

6.0 ASSESSMENT AND OVERSIGHT

Assessments and oversight reports to management are necessary to ensure that procedures are followed as required and that deviations from procedures are documented. These reports also serve to keep management current on field activities. Assessment, oversight reports, and response actions are discussed below.

6.1 Assessments

Performance assessments are quantitative checks on the quality of a measurement system and are appropriate to analytical work. Performance assessments for the laboratories may be accomplished by submitting reference material as blind reference (or performance evaluation) samples. These assessment samples have known concentrations of LA that are submitted to the laboratories without informing the laboratories that they are performance evaluation samples. Laboratory audits may be conducted upon request from the EPA Team Leader (TL) or Volpe Center PM.

System assessments are qualitative reviews of different aspects of project work to check on the use of appropriate QC measures and the functioning of the QA system. Project assessments will be performed under the direction of the QA managers, who report directly to the CDM president. Quality Procedure 6.2, as defined in the CDM QA Manual (CDM 2005d), defines CDM 's corporate assessments, procedures, and requirements. Due to the amount of sampling and the duration of the Libby project, both a field audit and an office audit are scheduled for the Site annually.

6.2 Response Actions

Response actions will be implemented on a case-by-case basis to correct quality problems. Minor response actions taken in the field to immediately correct a quality problem will be documented in the applicable field logbook and a verbal report will be provided to the CDM PM. For verbal reports, the CDM PM will complete a communication log to document the response actions were relayed to him/her. Major response actions taken in the field will be approved by the CDM PM, the EPA TL, and Volpe PM prior to implementation of the change. Major response actions are those that may affect the quality or objective of the investigation. Quality problems that cannot be corrected quickly through routine procedures may require implementation of a corrective action request (CAR) form.

All formal response actions will be submitted to either CDM ’s Quality Assurance (QA) manager and/or project QA coordinator for review and issuance. CDM ’s PM or local QA coordinator will notify the QA manager when quality problems arise that may require a formal response action. CAR forms will be completed according to Quality Procedure 8.1 of the CDM QA Manual (CDM 2005d).

In addition, when modifications to this specific SAP are required, either for field or laboratory activities, a Libby Asbestos Project Record of Modification Form (Attachment C) must be completed.

6.3 Reports to Management

QA reports will be provided to management whenever quality problems are encountered. Field staff will note any quality problems on field data sheets, or in field logbooks. CDM’s PM will inform the project QA coordinator upon encountering quality issues that cannot be immediately corrected. Weekly reports and change request forms are not required for this work assignment. Monthly QA reports will be submitted to CDM ’s QA manager by the project QA coordinator.

Topics to be summarized regularly may include but not be limited to:

- Document technical and QA reviews that have been conducted
- Activities and general program status
- Project meetings
- Corrective action activities
- Any unresolved problem
- Any significant QA/QC problems not included above

7.0 DATA VALIDATION AND USABILITY

Laboratory results will be reviewed for compliance with project objectives. Data validation and evaluation are discussed in Sections 7.1 and 7.2, respectively.

7.1 Data Review, Validation, and Verification Requirements

Data review, validation, and verification will be performed for important investigative samples as described in the Site-Wide QAPP. Data validation, review, and verifications must be performed on sample results before distribution to the public for review. Requirements for the frequency of data review are initially set at 10%. This initial rate may be revised as initial samples are analyzed and results evaluated.

Data validation consists of examining the sample data package(s) against pre-determined standardized requirements. The validator may examine, as appropriate, the reported results, QC summaries, case narratives, COC information, raw data, initial and continuing instrument calibration, and other reported information to determine the accuracy and completeness of the data package. During this process, the validator will verify that the analytical methodologies were followed and QC requirements were met. The validator may recalculate selected analytical results to verify the accuracy of the reported information. Analytical results will then be qualified as necessary.

Data verification includes checking that results have been transferred correctly from laboratory data printouts to the laboratory report and to the EDD. Data verification for this project is primarily performed as a function of built-in quality control checks in the Libby project database when data is uploaded. However, the sample coordinator will notify the laboratories and the project database manager (Mr. Mark Raney, Volpe Center) of any discrepancies found during data usage.

7.2 Reconciliation with Data Quality Objectives

Once data has been generated, CDM evaluates data to determine if DQOs were achieved. This achievement will be discussed in the measurement report, including the data and any deviations to this SAP. Sample data will be maintained in the project database (Libby2). Laboratory QC sample data will be stored in hard copy (in the project files) and in Libby2.

8.0 PROJECT SCHEDULE

It is anticipated that initial outdoor assessments to determine locations for outdoor ABS sample collection will begin in May 2007. The first event of outdoor ABS sampling is currently planned to be conducted from June 2007 to August 2007. It is anticipated that results from this round of sampling will be available for tabulation and release for public review in October 2007.

9.0 REFERENCES

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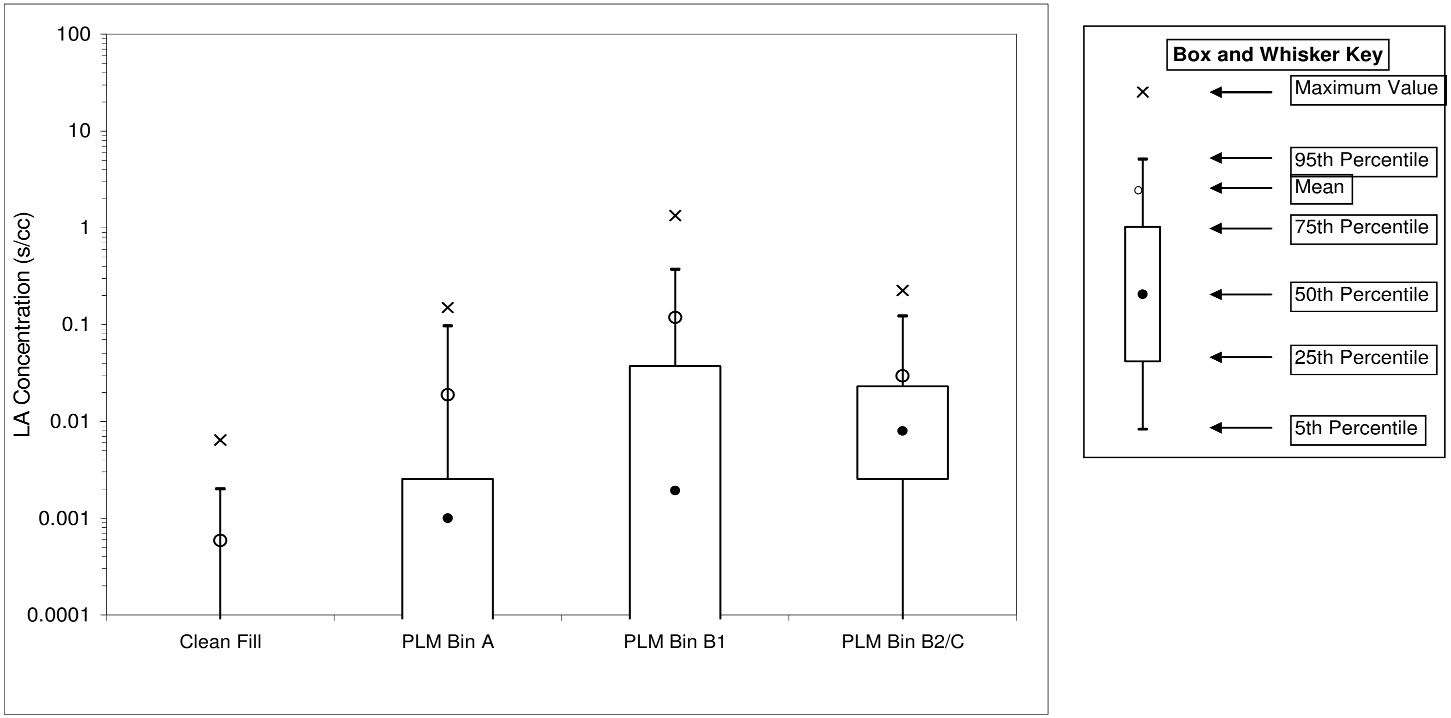
Table 4-1 Summary of Field QC Samples by Media

Media	Sample Type	Minimum Collection Frequency		Minimum Analysis Frequency	Acceptance Criteria	Acceptance Criteria Failure Action
Air	Lot Blank	1 per 50 cassettes	2%	1 per 50 cassettes	ND for all asbestos	Rejection of all cassettes in lot
	Field Blank	1 per property per day		10% of total collected per week	ND for all asbestos fibers	Analysis of additional field blanks to determine source of potential cross-contamination, qualification of sample results, evaluation of field sample handling procedures
	Co-located	1 per 20 samples	5%	100%	>90% RPD	Evaluation of sample collection techniques
Soil	Field Duplicate	1 per 20 samples	5%	100%	>90% RPD	Evaluation of sample collection techniques
	Equipment Blank	1 per team per week		1 per week	ND for all asbestos fibers	Evaluation of sample collection techniques, possible qualification of sample results during validation/evaluation

Notes: QC - quality control; ND - nondetect; RPD - relative percent difference; COC - chain of custody

FIGURE 2-1
TOTAL LA LEVELS IN PERSONAL ABS AIR SAMPLES NEAR SOIL DISTURBANCES



Metric	Soil Category			
	Clean Fill	PLM Bin A	PLM Bin B1	PLM Bin B2/C
N	21	10	21	13
DF	24%	60%	67%	77%
Max	0.006	0.150	1.34	0.23
95%	0.002	0.097	0.374	0.123
75%	0.000	0.003	0.037	0.023
50%	0.000	0.001	0.002	0.008
25%	0.000	0.000	0.000	0.003
5%	0.000	0.000	0.000	0.000
Mean	0.00059	0.019	0.12	0.029

FIGURE 3-1
EXAMPLE UNCERTAINTY IN THE MEAN
OF A LOGNORMAL DATA SET WITH σ = 2.0

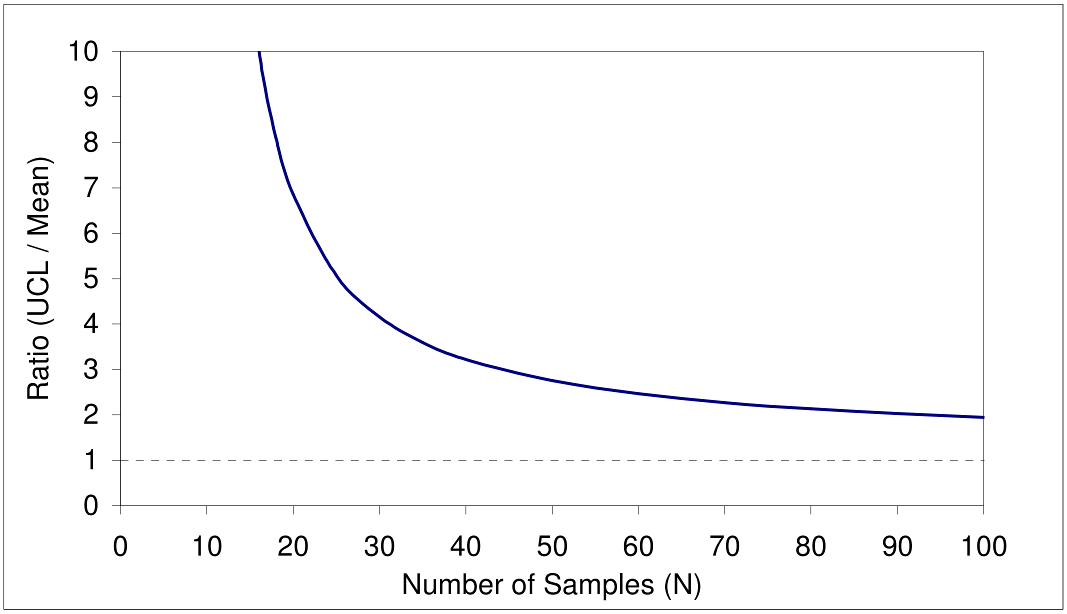


FIGURE 4-1 STUDY AREA BOUNDARIES